

# Complexities of Pulmonary Tuberculosis: A Global Health Challenge

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## DESCRIPTION

Pulmonary Tuberculosis (TB) remains one of the most significant infectious diseases worldwide, posing a persistent threat to public health and socioeconomic development. Despite decades of medical advancements and concerted efforts to control the disease, TB continues to exact a heavy toll, particularly in low- and middle-income countries. In this article, we delve into the multifaceted nature of pulmonary TB, exploring its epidemiology, pathogenesis, clinical manifestations, diagnostic modalities, treatment strategies, and the ongoing challenges in TB control and prevention.

## Epidemiology

Pulmonary TB is caused by the bacterium *Mycobacterium tuberculosis*, which primarily affects the lungs but can also disseminate to other organs in the body. According to the World Health Organization (WHO), TB remains one of the top 10 causes of death worldwide, with an estimated 10 million new cases and 1.4 million deaths annually. The burden of TB is disproportionately borne by low- and middle-income countries, where factors such as poverty, overcrowding, malnutrition, and limited access to healthcare contribute to the spread of the disease.

## Pathogenesis

The pathogenesis of pulmonary TB begins with the inhalation of airborne droplets containing *M. tuberculosis* bacilli. Once inhaled, the bacteria are engulfed by alveolar macrophages and evade host immune responses by residing within these cells. Over time, infected macrophages accumulate in granulomas, which serve as the important pathological feature of TB. While granulomas help contain the infection, they can also serve as a reservoir for persistent bacteria, leading to Latent TB Infection (LTBI) or active disease.

## Clinical manifestations

The clinical presentation of pulmonary TB can vary widely, ranging from asymptomatic infection to severe, life-threatening

disease. Common symptoms of active pulmonary TB include cough, fever, night sweats, weight loss, and hemoptysis. In severe cases, TB can lead to complications such as pleural effusion, miliary TB, and respiratory failure. The progression from latent infection to active disease depends on various factors, including host immune status, bacterial virulence, and environmental exposures.

## Diagnostic modalities

Diagnosing pulmonary TB relies on a combination of clinical evaluation, microbiological testing, and radiographic imaging. Sputum smear microscopy, culture, and Nucleic Acid Amplification Tests (NAATs) are commonly used to detect *M. tuberculosis* in respiratory specimens. Chest radiography and Computed Tomography (CT) scans are valuable tools for evaluating pulmonary abnormalities and assessing disease severity. Additionally, Tuberculin Skin Testing (TST) and Interferon-Gamma Release Assays (IGRAs) can help identify individuals with LTBI.

## Treatment strategies

The cornerstone of pulmonary TB treatment is a multidrug regimen consisting of isoniazid, rifampicin, pyrazinamide, and ethambutol. This combination therapy aims to eradicate the bacteria, prevent the development of drug resistance, and reduce the risk of treatment failure and relapse. Directly Observed Therapy (DOT) is recommended to ensure treatment adherence and monitoring. In cases of drug-resistant TB, treatment regimens must be making based on drug susceptibility testing results and may require prolonged therapy with second-line agents.

## Challenges in TB control and prevention

Despite significant progress in TB control efforts, several challenges persist in the fight against pulmonary TB. These include inadequate access to healthcare services, diagnostic delays, poor treatment adherence, stigma and discrimination, and the emergence of drug-resistant strains. Furthermore, the COVID-19 pandemic has exacerbated existing challenges by

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disrupting TB services, diverting resources, and exacerbating social determinants of health.

## CONCLUSION

Pulmonary tuberculosis remains a formidable global health challenge, requiring sustained efforts and innovative approaches to control and prevention. While progress has been made in

reducing TB incidence and mortality, much work remains to be done, particularly in addressing the social, economic, and structural determinants of TB. By strengthening health systems, expanding access to diagnostics and treatment, and addressing underlying social inequalities, we can hope to achieve the goal of ending the TB epidemic by 2030, as outlined in the WHO's End TB Strategy.